

REMARKS

INTRODUCTION

Claims 8 and 18 have been cancelled without prejudice or disclaimer. Claims 1, 9 and 11 have been amended. No new matter is added. Claims 1-7, 9-17, 19 and 25 are under consideration. Claims 20-24 and 26-30 are withdrawn.

REJECTION UNDER 35 U.S.C. §102

Claims 9-10 are rejected under 35 U.S.C. §102(b) as being anticipated by Kim et al. "Synthesis and Characterization of Polyether Urethane acrylate-LiCF₃SO₃-based Polymer Electrolytes by UV-curing in Lithium Batteries," hereafter referenced as Kim et al.

It is respectfully submitted that Kim et al. teaches utilizing a very low molar concentration of lithium salt, i.e., 0.079 M to 0.11 M. This is seen from, in Table 1 of Kim et al., the molar compositions of lithium salt are, respectively:

P1 11.89/140=0.085 M

P2 11.89/140=0.085 M

P3 14.16/140=0.10 M

P4 14.16/140=0.10 M

P5 9.48/120=0.079 M

P6 13.53/120=0.11 M

The concentration of lithium salt in the cross-linked polyether urethane in the present invention is much higher, ranging from approximately 0.5 to 2 M. Independent claim 9 has been amended to recite this more clearly. Since claim 10 depends from amended claim 9, claim 10 is respectfully submitted to be allowable for at least the reasons that amended claim 9 is allowable.

It should be noted that using the concentration of lithium salt taught by Kim et al. produced uncontrolled passivation phenomena associated with a continuous growth of a resistive layer on the lithium electrode surface, affecting the cyclability of lithium electrodes and therefore the entire lithium battery (see lines 5-18 of col. 2 on page 21 of Kim et al.).

In contrast, the polymeric electrolyte of the present invention, which has a lithium salt concentration ranging from approximately 0.5 to 2 M, has not been shown to exhibit the above disadvantages cited by Kim et al. (see FIGs. 2-3 and paragraphs 51 and 54 of the specification).

Thus, it is respectfully submitted that claims 9-10 are allowable under 35 U.S.C. §102(b) and are not anticipated by Kim et al. "Synthesis and Characterization of Polyether Urethane acrylate-LiCF₃SO₃-based Polymer Electrolytes by UV-curing in Lithium Batteries."

Rejection under 35 U.S.C. §102, §103

I. Claims 1-8, 11-17 and 25 are rejected under 35 U.S.C. §102(b) as being anticipated by, or in the alternative, under 35 U.S.C. §103(a) as being obvious over Le Nest et al. "Mechanism of Ionic Conduction in Polyether-Polyurethane Networks," hereafter referenced Le Nest et al.

Claim 1 has been amended to show more clearly that the present invention implements a concentration of lithium salt in the cross-linked polyether urethane ranging from approximately 0.5 to 2 M, that is much higher than the concentration of lithium salt utilized in the polyether-polyurethane electrolyte of the prior art. Claim 8 has been cancelled without prejudice or disclaimer.

It is clear that the concentrations of lithium salt in the polyether-polyurethane electrolyte taught by Le Nest et al. are very small in comparison with the concentrations of lithium salt in the polymeric electrolyte of the present invention. For example, on page 341 Le Nest et al. states: "If n lithium cations solvated by a given PEO chain induce its partitioning into (n+1) subchains, each containing N bonds, then it follows that $N = N_0/(1 + n)$ and $n = 9.4 \times 10^{-5} C M$, where N_0 is the number of bonds per PEO chain of molecular weight M." (emphasis added) On page 340, Le Nest et al. defines C: "C is expressed in g LiClO₄/100 g of PEO). Thus, the molarity of lithium salt is very small, and does not approach the range of approximately 0.5 to 2 M, which is utilized

by the present invention. Again, since such a small concentration of lithium salt is utilized by Le Nest et al., it is respectfully submitted that the results of Le Nest et al. cannot generally be compared with the results of the present invention, especially in view of the results noted by Kim et al. above.

Thus, the results of the present invention are unexpected, since problems had been noted with lower concentrations of lithium salts. There is no teaching or suggestion that utilizing a range of approximately 0.5 to 2 M lithium salt in a polymeric electrolyte comprising a cross-linked polyether polyurethane prepared according to the present invention would provide a useful electrolyte.

Since claims 2-7 and 25 depend from amended claim 1, claims 2-7 and 25 are submitted to be allowable over Le Nest et al. for at least the reasons that amended claim 1 is allowable over Le Nest et al.

In accordance with paragraph 8 of page 6 of the Office Action, claim 11 has been amended to include the features of claim 18. Thus, amended claim 11 is submitted to be allowable. Claim 18 has been cancelled without prejudice or disclaimer. Since claims 12-17, 19 and 25 depend from amended claim 11, claims 12-17, 19 and 25 are submitted to be allowable for at least the reasons that amended claim 11 is allowable.

Thus, it is respectfully submitted that claims 1-7, 11-17, 19 and 25 are allowable under 35 U.S.C. §102(b) and are not anticipated by, or under 35 U.S.C. §103(a) obvious in view of, Le Nest et al. "Mechanism of Ionic Conduction in Polyether-Polyurethane Networks."

II. Claims 1-8, 11-17, and 25 are rejected under 35 U.S.C. §102(b) as being anticipated by, or in the alternative, under 35 U.S.C. §103(a) as being obvious over by Kim et al. "Synthesis and Characterization of Polyether Urethane acrylate-LiCF₃SO₃-based Polymer Electrolytes by UV-curing in Lithium Batteries," hereafter referenced as Kim et al.

Claim 1 has been amended to show more clearly that the present invention implements a concentration of lithium salt in the cross-linked polyether urethane ranging from approximately 0.5 to 2 M, that is much higher than the concentration of lithium salt utilized in the polyether-polyurethane electrolyte of the prior art. Claim 8 has been cancelled without prejudice or disclaimer.

As described for amended claim 9 above, it is respectfully submitted that amended claim 1 recites a concentration that is much higher than the concentration of lithium salt utilized in the polyether-polyurethane electrolyte of Kim et al. In particular, Kim et al. recites passivation problems for an electrode, wherein the problems are associated with utilizing the low concentration (0.07 to 1.1 M) lithium salts. Generally, when such a problem exists for a low concentration of an ion, a higher concentration of the ion simply exacerbates the problem. Hence, it is respectfully submitted that Kim et al. does not teach using the concentration of lithium salt recited for the present invention, and also does not suggest using such a concentration of lithium salt. Hence, the results of using the higher concentration of lithium salt, as set forth in the present invention, are unexpected and non-obvious, as well as unanticipated.

Since claims 2-7 and 25 depend from amended claim 1, claims 2-7 and 25 are submitted to be non-anticipated and non-obvious with respect to Kim et al. for at least the reasons that amended claim 1 is submitted to be non-anticipated and non-obvious.

In accordance with paragraph 8 of page 6 of the Office Action, claim 11 has been amended to include the features of claim 18. Thus, amended claim 11 is submitted to be allowable. Claim 18 has been cancelled without prejudice or disclaimer. Since claims 12-17, 19 and 25 depend from amended claim 11, claims 12-17, 19 and 25 are submitted to be allowable for at least the reasons that amended claim 11 is allowable.

Thus, it is respectfully submitted that claims 1-7, 11-17, 19 and 25 are allowable under 35 U.S.C. §102(b) and are not anticipated by, or under 35 U.S.C. §103(a) obvious in view of, Kim et al. "Synthesis and Characterization of Polyether Urethane acrylate-LiCF₃SO₃-based Polymer Electrolytes by UV-curing in Lithium Batteries."

CONCLUSION

In accordance with the foregoing, claims 1, 9, and 11 have been amended. Claims 8 and 18 have been cancelled. Claims 1-7, 9-17, 19 and 25 are under consideration.

There being no further outstanding objections or rejections, it is submitted that the application is in condition for allowance. An early action to that effect is courteously solicited.

Finally, if there are any formal matters remaining after this response, the Examiner is requested to telephone the undersigned to attend to these matters.

If there are any additional fees associated with filing of this Amendment, please charge the same to our Deposit Account No. 19-3935.

Respectfully submitted,

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